



Designing of Endwinding Corona Protection by help of Simulation



Milan, 09.10.2012

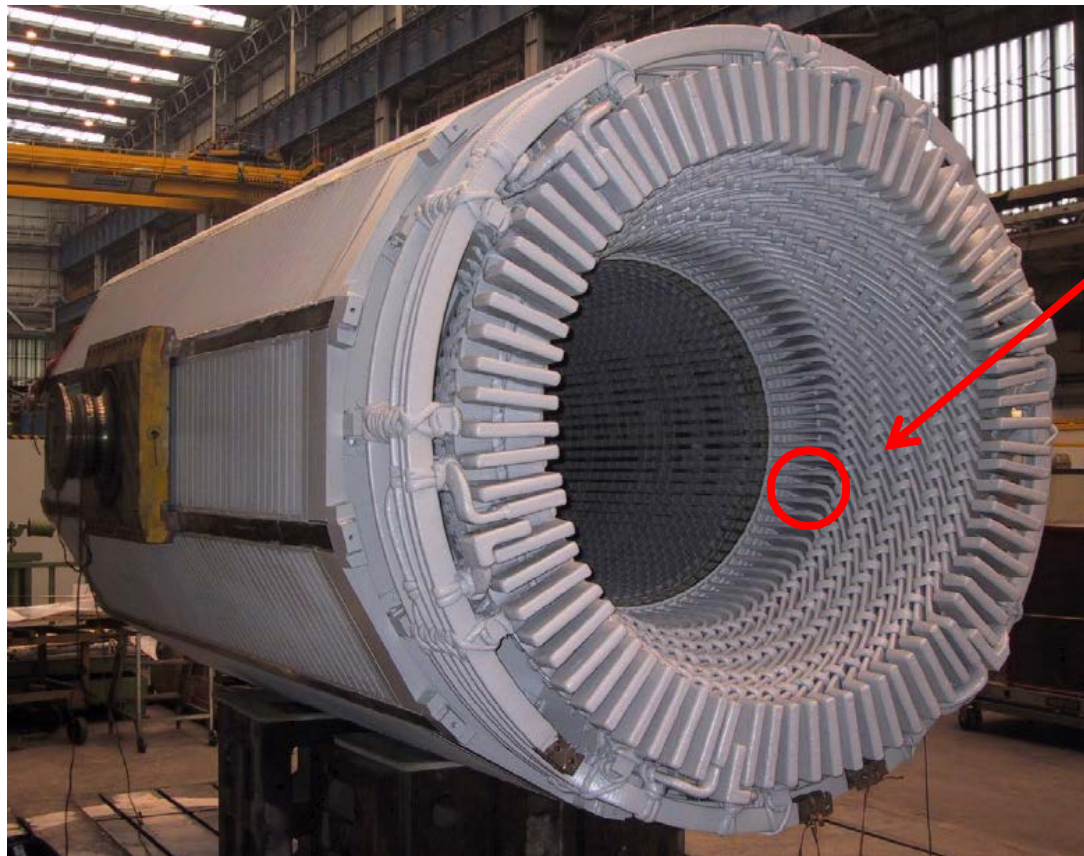
Moyan Wei

Outline

- 1 Introduction and Motivation
- 2 Simulative approach with COMSOL
- 3 Conclusion

1 Introduction and Motivation

Field of application – HV Rotating Machines

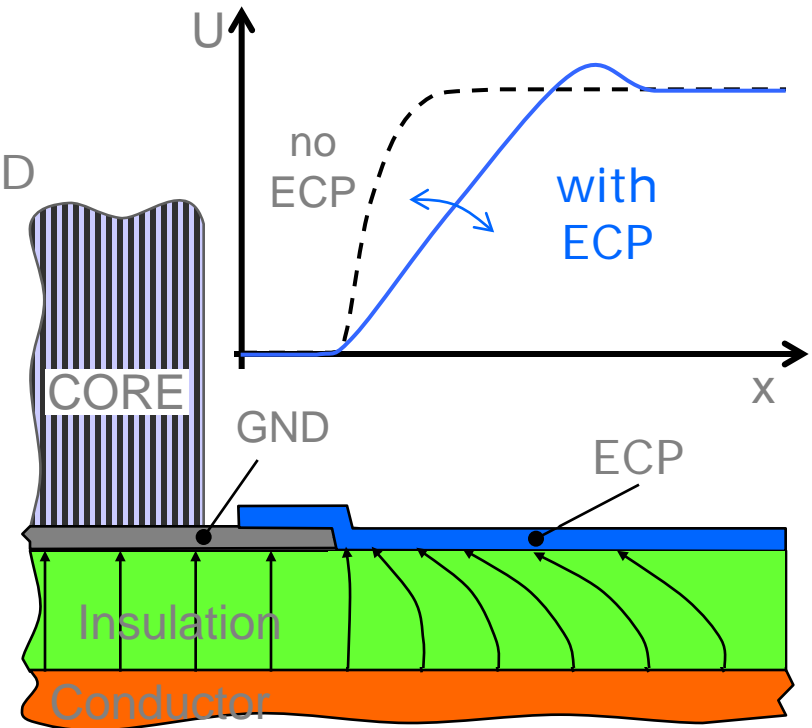


**Endwinding
Corona
Protection
(ECP)**

1 Introduction and Motivation

Potential Control

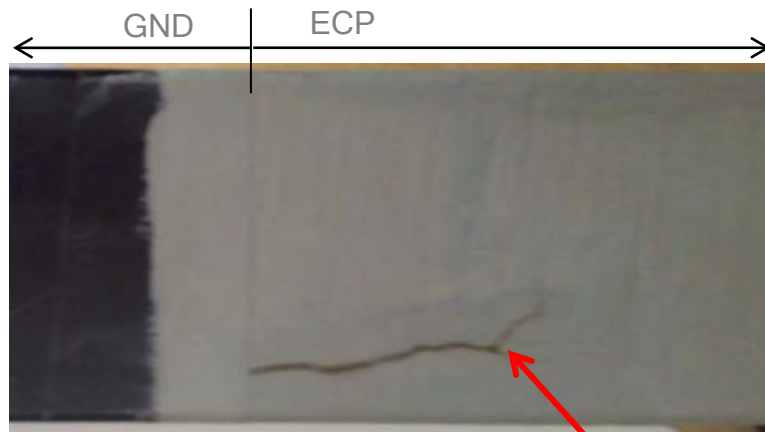
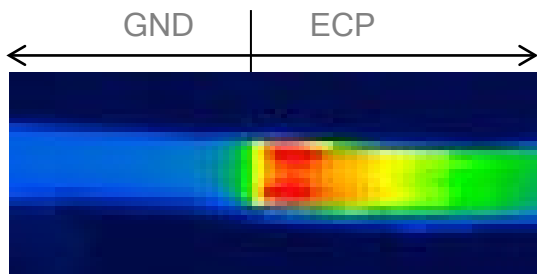
- Potential jump at the end of GND
- This potential jump could lead to discharge, which are harmful to the insulation
- Control of potential distribution is realized by applying ECP layer onto the coil surface



Problem: ECP causes extra loss and heating

1 Introduction and Motivation

Overheating of the ECP



Thermal runaway

To be clear:

- Value of the field strength
- Temperature of the Object

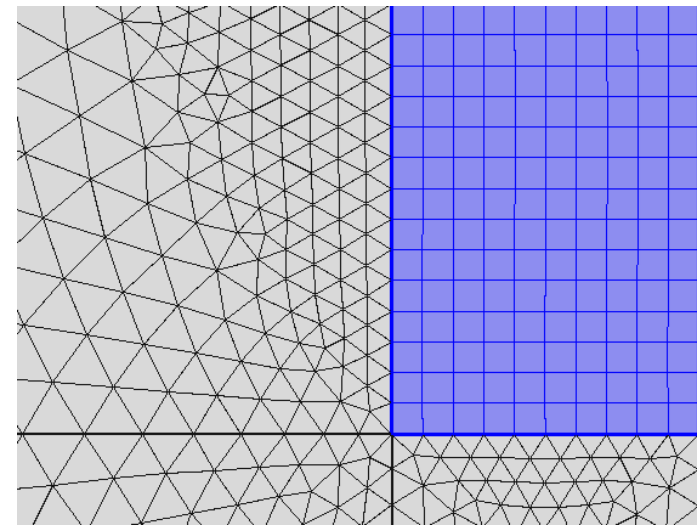
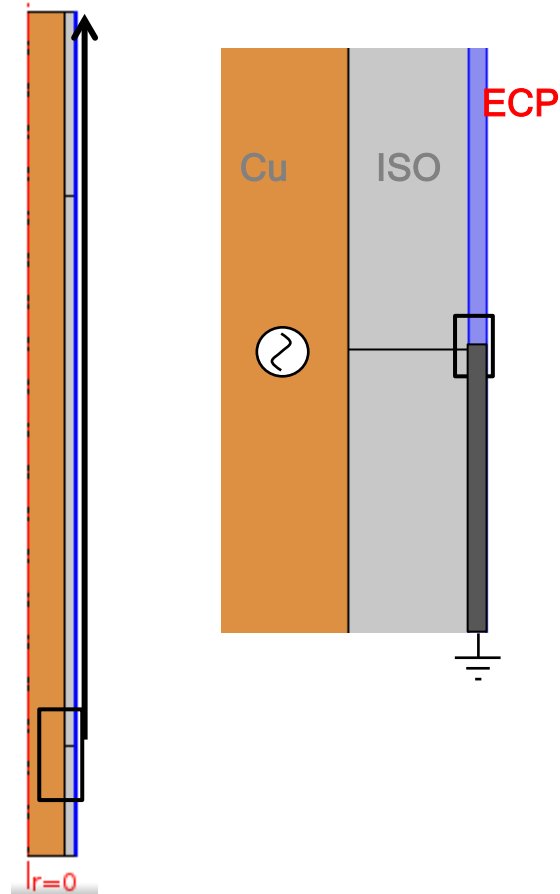


Study the details of electrical and thermal behavior of ECP



FEM modeling:
Electric Current
Heat Transfer

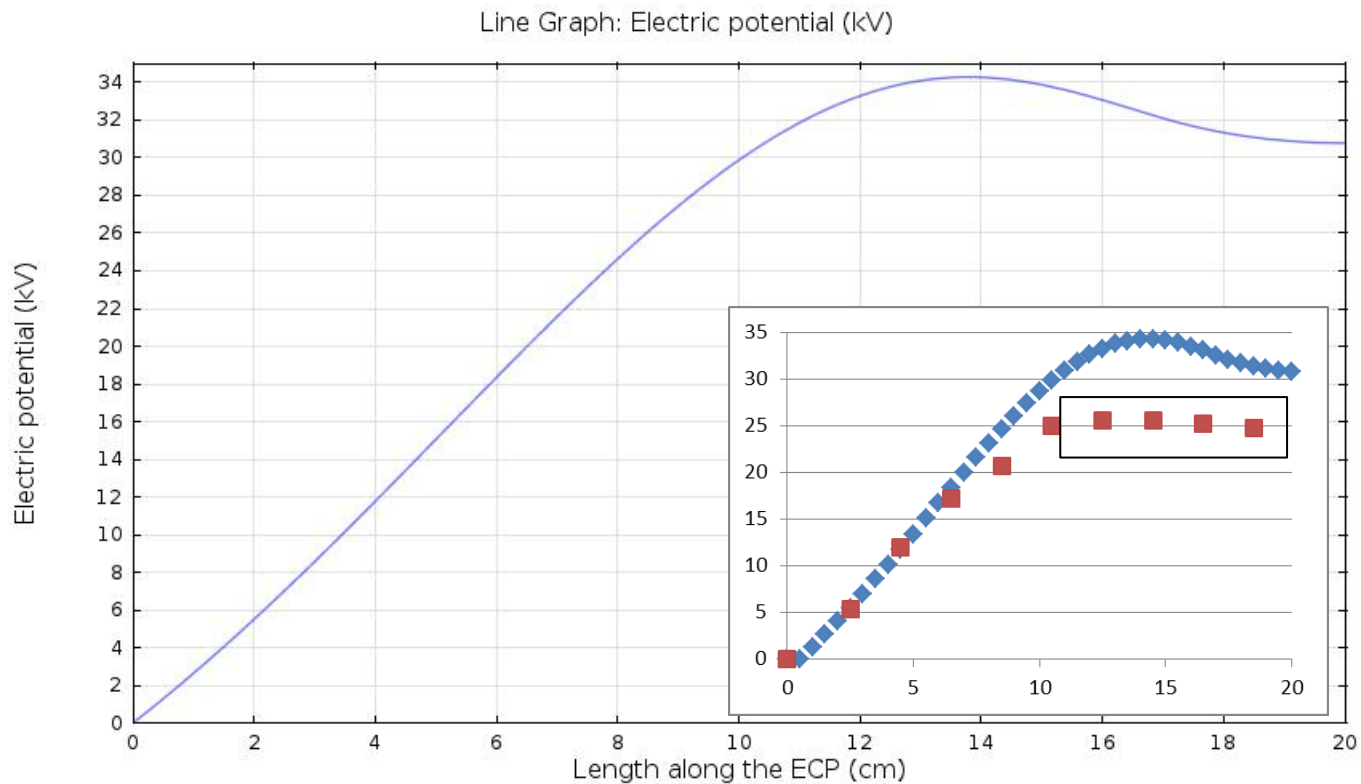
2 Simulative Approach 2D Axisymmetric



Electric Current: AC (50Hz $\hat{U}=31\text{kV}$), GND

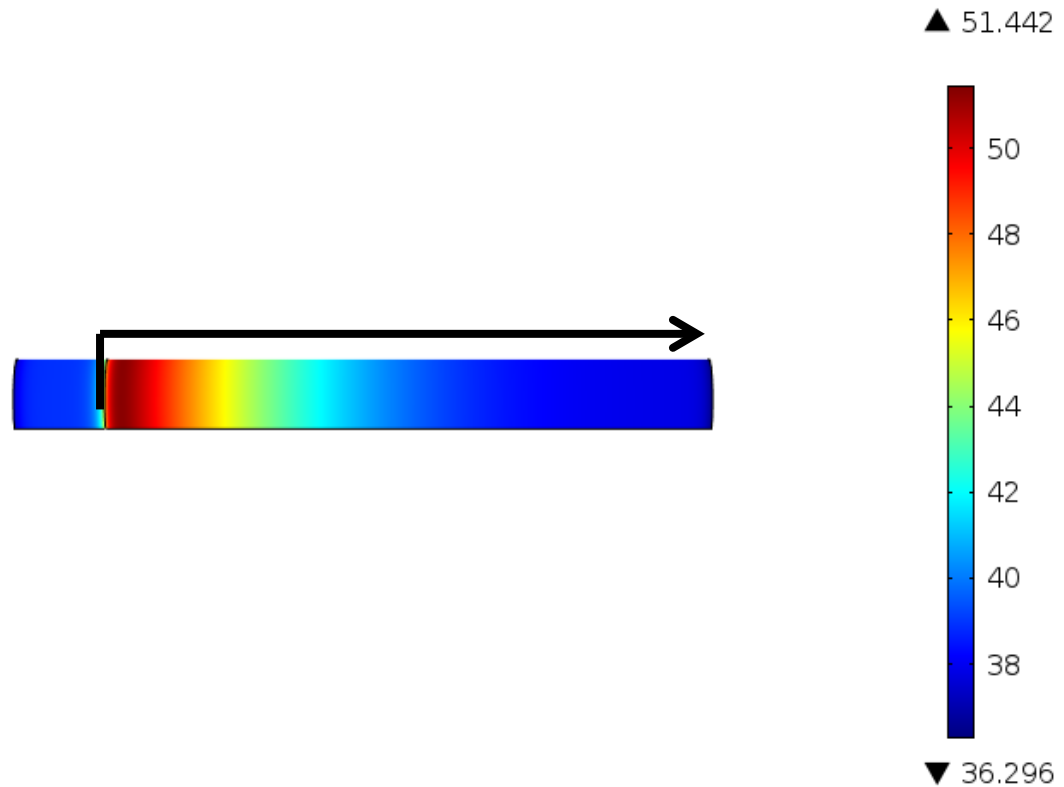
Heat Transfer: ECP as heat source;
initial and ambient temperature: 25°C ;
convective and radiative cooling.

2 Simulative Approach Potential Distribution $\hat{U}=31$ kV



The inner impedance of the probe has influenced the measurement!

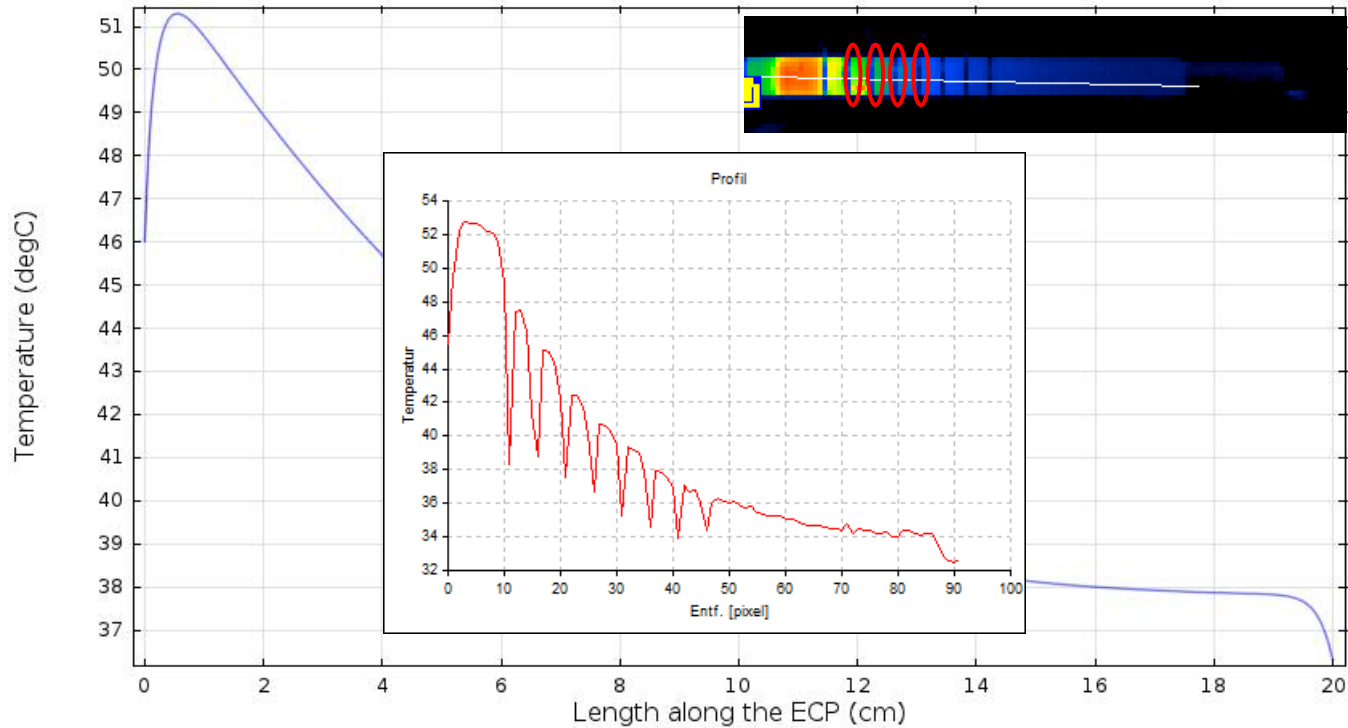
2 Simulative Approach Temperature Distribution 2D $\hat{U}=31$ kV



2 Simulative Approach

Temperature Distribution 2D $\hat{U}=31$ kV

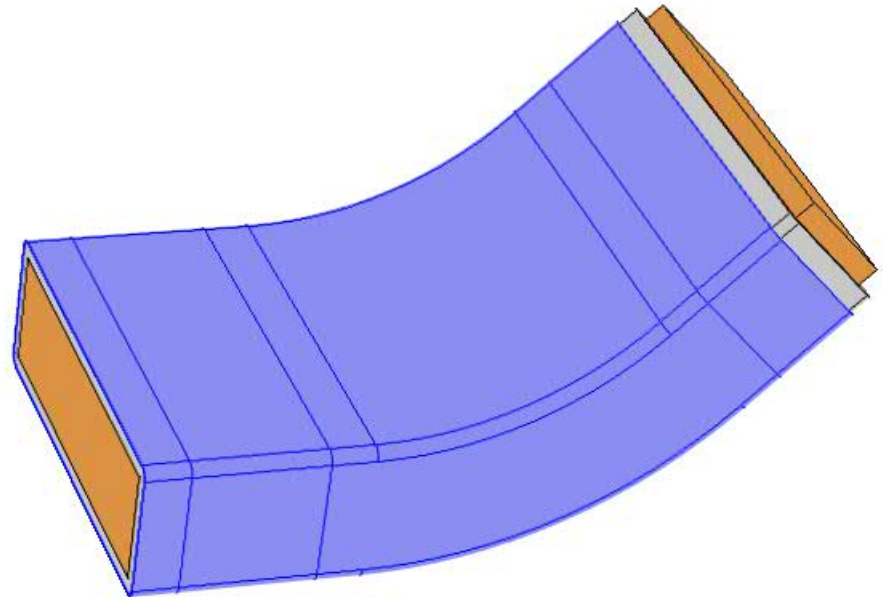
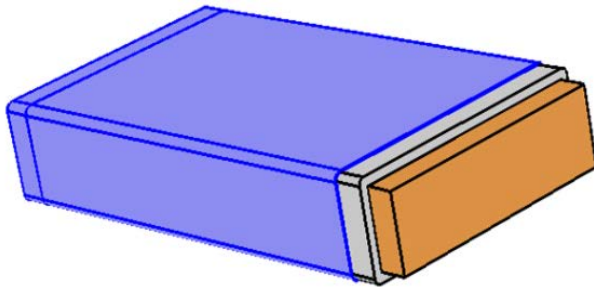
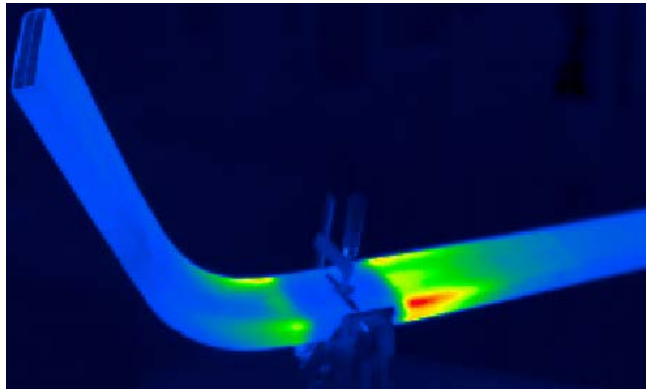
Line Graph: Temperature (degC)



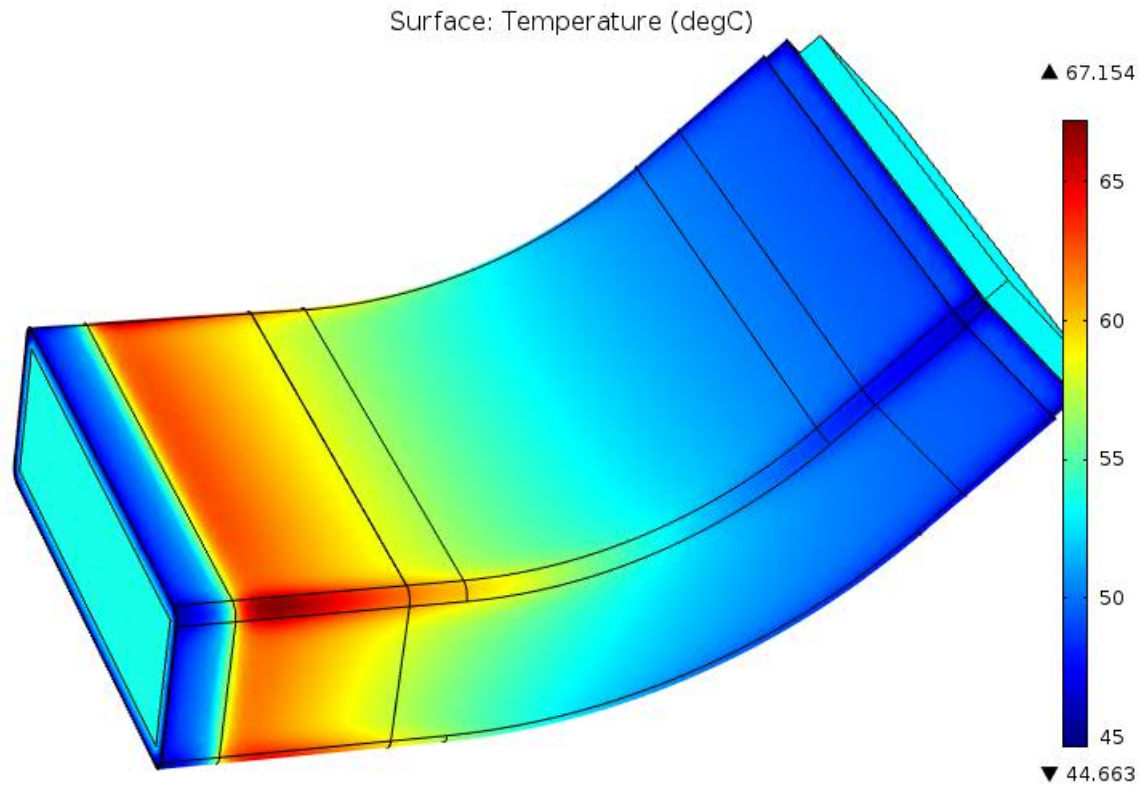
Cu strips serve as measuring electrodes, but have different emissivity



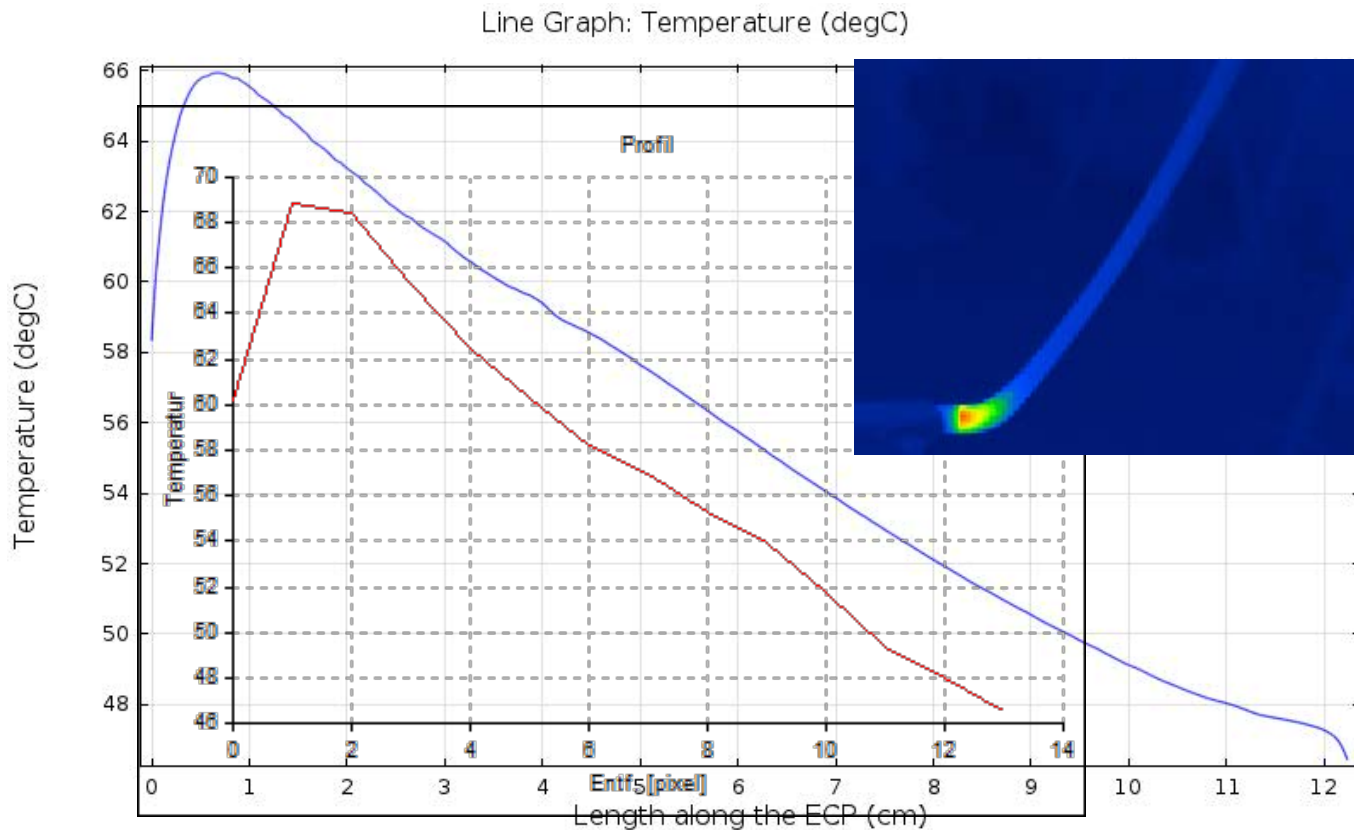
2 Simulative Approach 3D Modeling



2 Simulative Approach Temperature Distribution: 3D $\hat{U}=31$ kV



2 Simulative Approach Temperature Distribution: 3D $\hat{U}=31$ kV





3 Conclusion

- Simulation tools for 2D and 3D were developed
- Pre-calculation: Potential distribution
- Pre-calculation: Heating effect
- Experimental verification
- Successfully applied in ECP design

Thank you for your attention